NAME (as it appears on your UF ID): _____
(Please **PRINT**)

UF Student ID#: _____

---------- CEN 4072/6070 Software Testing & Verification ----------

Exam 1 -- Spring 2015

You have 90 minutes to work on this exam. It is a "closed-book/closed-notes" test. Pay attention to point values, since you may not have time to work all 21 problems. PRINT your name and UF ID# above NOW and sign the pledge at the bottom of the last page, if appropriate, when you are finished. PLEASE PRINT ANSWERS IN THE SPACE PROVIDED ONLY – PREFERABLY USING A BALLPOINT PEN TO INCREASE LEGIBILITY. Good luck!

1. (6 pts.) Briefly elucidate (i.e., explain and make clear) each of the following terms in the context of Ken Johnston's talk, "The Future of Testing is EaaS*y*."

   a. *scrummerfall:*

   b. *code churn:*

2. (6 pts.) In his recent Guest Lecture, Joseph Cutrono described "*mocking"* in the context of unit testing.

   a. What is *mocking* in this context?

   b. What benefit(s) does *mocking* provide?

3. As discussed in class, a distinction is sometimes drawn between the terms *validation testing* and *defect testing.*

   a. (4 pts.) Describe this distinction.

   b. (3 pts.) Which of these terms more closely reflects the definition of testing attributed in class to Boris Beizer? Briefly explain.

4. (6 pts.) Briefly define each of the following software testing-related terms.

   a. *regression testing:*

   b. *alpha testing:*

   c. *"lights out" testing:*

5. (3 pts.) The performance and reliability of systems are normally measured using *statistical testing* and make use of an *operational profile.* What is an *operational profile* and why is it needed in this context?

6. (3 pts.) Recall the pseudocode program below discussed in class.

```
if (input is other than an ordered pair of numbers)
    then output("invalid input")
else
    if x<y then output("ascending order")
    else
        if x>y then output("ascending order")
        else
            output("equal")
```

Which one of the following statements best reflects the *primary* point made in connection with this program? (Circle ONE only.)

a. Correctness of the program cannot be determined in the absence of its requirements.

b. Correctness of the program can only be determined using BOTH black-box and white-box testing.

c. Attempting to count the "number of bugs/errors" in the program is probably not meaningful.

d. The program illustrates a design for which the underlying assumption of partition testing would hold for the equivalence classes identified in class.

e. Correctness of the program can only be determined using statistical testing.

f. (none of the above.)

7. (3 pts.) One of the important "lessons" of the pow() black-box testing case study concerned the potential usefulness of seeking out "implicit requirements" for functions that may not be included in, or are not readily apparent from, the documentation provided. Briefly describe how this idea was illustrated with the pow() example.

8. (3 pts.) How is the integer variable "errno" used when the fmod() function is called? In particular, how should an application calling fmod() make use of "errno".

9. (12 pts.) One of the issues discussed in class regarding the use of *Cause-Effect Analysis* for black-box test case design concerned the pros and cons of models based on a set of mutually exclusive Effects. Briefly discuss this issue as it applies to the two program specifications (given as MAN pages) of "Problem Set 1: Black-Box Testing." In particular, identify and briefly describe the functions specified, indicate which approach (defining Effects that are mutually exclusive or not) was the most appropriate for each (hint: consider the models given in the posted solution notes), and briefly explain ***why*** the approach used for each was the most appropriate.

10. Suppose the 3-dimensional input space for a function that returns a Boolean value is comprised of 2, 2, and 3 disjoint attribute classes respectively, with no infeasible input combinations.

    a. (6 pts.) What is the minimum number of test cases needed to achieve *"Strong Equivalence Class Testing"* ? What is the minimum number needed to achieve *"Weak Equivalence Class Testing"?*

       minimum # of cases needed for *strong equivalence class testing:* _____

       minimum # of cases needed for *weak equivalence class testing:* _____

    b. (4 pts.) Joseph Cutrono, in his recent Guest Lecture, described another combinatorial testing criterion called "all-pairs." What is the minimum number of test cases needed to achieve *"All-Pairs Equivalence Class Testing"?*

       minimum # of cases needed for *all pairs equivalence class testing:* _____

    c. (3 pts.) Suppose a given implementation of this function has a total of 7 execution paths, all of which are feasible. If the function's 3-dimensional input space is partitioned according to the values to which inputs should (based on the function's specification) be mapped, what is the minimum number of test cases needed to ensure coverage of the partitions?

       minimum # of cases needed to cover the partitions: _____

11. (6 pts.) Consider pseudocode program:

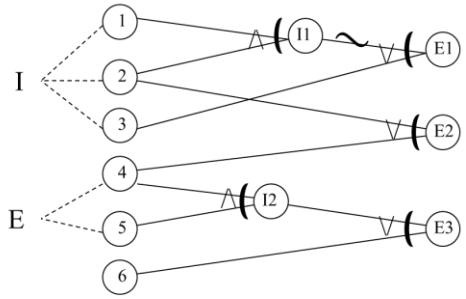
input (A,B); if (A OR B) then s1 end_if

for Boolean variables A and B. PROVE, using this program and one or more test case-based counter-examples, as needed, that

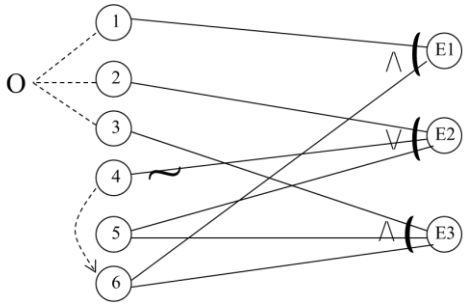
condition coverage and path coverage are independent

Explicitly identify any test case-based counter-example(s) used in your proof by identifying the Boolean input values assumed for A and B, the path(s) sensitized, etc. Your counter-example(s) and explanation must make your conclusion clear.

12. (6 pts.) Consider the two Cause-Effect graphs shown below. How many test cases would be required to achieve AFCCV (All Feasible Combinations of Cause Values) coverage for each? (Hint: E="at most one"; I="at least one"; O="one and only one")



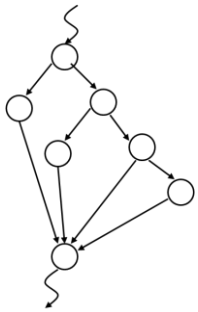
Cases required to achieve AFCCV: _____



Cases required to achieve AFCCV: _____

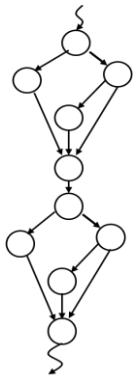
13. (16 pts.) For each of the following control flow graphs, indicate the number of complete program paths, test cases required for Basis Paths coverage, test cases required for Branch Coverage, and test cases required for Statement Coverage.

a.



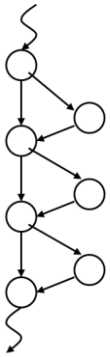
number of paths: _____
test cases for Basis Paths Coverage: _____
test cases for Branch Coverage: _____
test cases for Statement Coverage: _____

b.



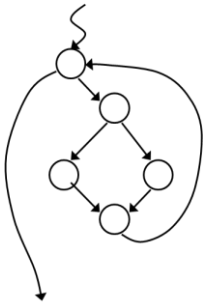
number of paths: _____
test cases for Basis Paths Coverage: _____
test cases for Branch Coverage: _____
test cases for Statement Coverage: _____

c.



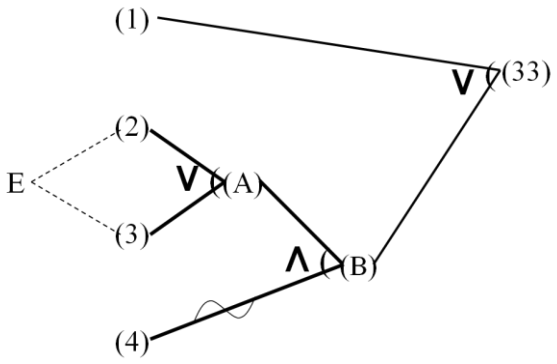
number of paths: _____
test cases for Basis Paths Coverage: _____
test cases for Branch Coverage: _____
test cases for Statement Coverage: _____

d.



number of paths: _____
test cases for Basis Paths Coverage: _____
test cases for Branch Coverage: _____
test cases for Statement Coverage: _____

14. (10 pts.) Consider the following Cause-Effect graph:



Identify **all feasible combinations of connected Cause values that result in Effect 33 being true, subject to the culling rules discussed in class**. Enter a test case template for each combination identified in the test case coverage matrix below. (Use as many columns in the matrix as needed.)

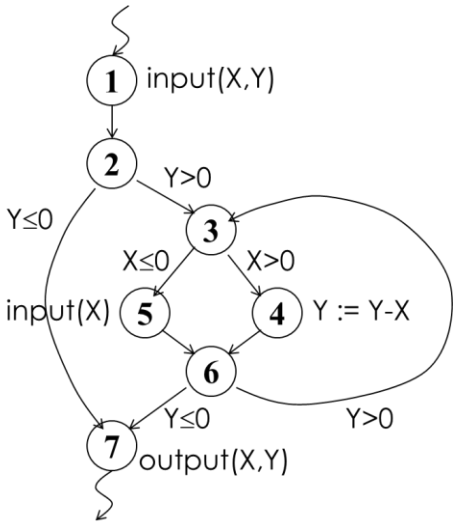
	TEST CASES									
CAUSES	1	2	3	4	5	6	7	8	9	10
(1)										
(2)										
(3)										
(4)										
EFFECT										
(33)										

15. In *"The six essentials of software testing,"* Edward Kit describes "the essentials of the software testing process that serve as the foundation" for his book, Software Testing in the Real World: Improving the Process. Essential #2 is "Prevent defect migration by using early life-cycle testing techniques."

a. (3 pts.) What, specifically, does he mean by "prevent defect migration"?

b. (3 pts.) What, specifically, does he mean by "early life-cycle testing techniques" and what example(s) of this does he mention?

16. (23 pts.) Consider the program control flow graph below.



a. Three of the du-pairs for variable Y are: (1,4), (1,<6,3>), and (4,7). Identify ALL **(and ONLY)** the REMAINING du-pairs for variable Y.

b. Identify all **(and ONLY)** the feasible du-paths associated with du-pair (1,4) for variable Y. (If none, enter "NONE".)

c. Identify all **(and ONLY)** the feasible du-paths associated with du-pair (1,<6,3>) for variable Y. (If none, enter "NONE".)

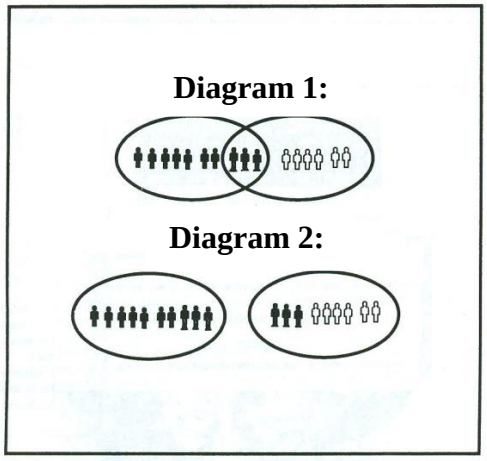
d. Identify all **(and ONLY)** the feasible du-paths associated with du-pair (4,7) for variable Y. (If none, enter "NONE".)

e. Give the **partial path condition** for partial path <1,2,3,4,6,3,5> in terms of X and Y input values. SHOW ALL TERMS.

f. Give the **path condition** for path <1,2,3,5,6,3,4,6,7> in terms of X and Y input values. SHOW ALL TERMS. (Hint: use "X1" to represent the first input value of X, "X2" to represent the second, etc.)

17. (3 pts.) In "The state of the art and the state of the practice," Edward Kit points to a problem in many organizations that "means the voice of testing often goes unheard. While the testing people do their job and report the results, they frequently find their management simply thanks them for their information, but ships the product anyway." To what specific problem is Kit referring?

18. Gause and Weinberg ("Making Meetings Work for Everyone") used the two Venn diagrams below in support of one of their recommendations about designing effective meetings.



a. (3 pts.) What was the specific recommendation?

b. (6 pts.) What do the two diagrams depict and what do the stick figures associated with each set represent?

19. (8 pts.) In the space provided below, compare and contrast the Fagan and HP inspection process step known as "Preparation" as described in the papers, "Design and Code Inspections" and "Key Lessons In Achieving Widespread Inspection Use." In particular, identify what is the same and what is different about what participants are supposed to do, what the goal(s) of the step is/are, and how the step is intended to prepare participants for the next step in each of the respective inspection processes.

20. In "The Effectiveness of Software Development Technical Reviews: A Behaviorally Motivated Program of Research," Sauer, et al., note that the behavioral theory of group performance, upon which their work on software reviews is based, involved laboratory studies of two-staged, multi-item judgment tasks.

    a. (4 pts.) What are the two stages associated with the judgment tasks they studied?

    b. (3 pts.) What is the specific example given by the authors of a judgment task used in their studies?

21. (9 pts.) Match each description below to the **SINGLE MOST APPROPRIATE TERM** among the following. (Note: terms may apply to none, one, or more than one description.)

A. Fault-based test	L. "Soak" test
B. Installability test	M. Device and configuration test
C. Thread test	N. Usability test
D. Alpha test	O. Serviceability test
E. Performance test	P. Beta test
F. Stress test	R. Security test
G. "Lights out" test	S. "Smoke" test
H. Regression test	T. Exhaustive test
I. Reliability test	U. Compatibility/conversion test
J. Post-test analysis	W. Causal analysis
K. Benchmarking	X. Test-driven development

_____ Testing which covers every possible combination of a program's input values

_____ General practice of recording and comparing indices of performance, quality, cost, etc., to help identify "best practices"

_____ Integrating program elements associated with a key program function

_____ testing system versions over a significant period of time to discover latent errors or performance problems (due to memory leaks, buffer/file overflow, etc.)

_____ Development process characterized by writing (and running) tests for new increments of functionality *before* they are implemented

_____ Focus is on typical requirements that systems exhibit "graceful" failures and non-abrupt performance degradation

_____ Process aimed at identifying the origin of errors and approaches to eliminate future occurrences

_____ Specialized testing in which HCI experts conduct experiments and utilize protocol analysis

_____ Issues of focus include login and password procedures and policies, levels of authorization for data or procedural access, etc.

On my honor, I have neither given nor received unauthorized aid on this exam and I pledge not to divulge information regarding its contents to those who have not yet taken it.

_____
SIGNATURE